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IMPORTANT FOREST PEST OUTBREAKS IN OREGON AND WASHINGTON IN 1974

by
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INSECT CONDITIONS IN BRIEF

Defoliator populations continued at a high level in the Pacific Northwest as a result of substantially increased activity recorded for the western spruce budworm in north central Washington and the modoc budworm in south central Oregon. Western spruce budworm infestations, causing variable amounts of damage over approximately 548,000 acres of Douglas-fir and true fir forests on the Okanogan and Wenatchee National Forests and the North Cascades National Park, more than doubled in area since 1973. One new infestation center, totaling 7,200 acres and consisting primarily of light defoliation, was observed on the Warm Springs Indian Reservation.

The modoc budworm, also more than doubling in area of visible feeding, caused primarily light defoliation over approximately 90,000 acres of white fir type in the Gearhart and Warner Mountains on the Fremont National Forest. One center of sugar pine tortrix observed in the North Warner Mountains caused light defoliation over 760 acres of lodgepole pine. Larch casebearer defoliation was again observed in both States. No formal surveys were conducted; however, field observers indicated that the intensity of damage appeared to be generally less then last year. Douglas-fir tussock moth populations significantly decreased following the application of DDT on 356,505 acres of infested forest lands in Oregon and Washington this past season.

The results of the 1974 aerial survey, confirming the post-spray sampling, indicate that Douglas-fir tussock moth populations have significantly declined in Oregon and Washington. Some additional defoliation was observed in and adjacent to research study sites in the Blue Mountains; in portions of the Eagle Cap Wilderness area; and in the untreated breaks of the Snake River Canyon. However, no significant defoliation was observed in any of the treatment areas and only one new center, totaling less than 10 acres and located in Stevens County near Daisy, Washington, was recorded.

Sucking insect activity, primarily caused by the balsam woolly aphid, decreased in Oregon. However, specimens and damage resulting from this pest were found on subalpine fir near the headwaters of Tiger Creek on the Walla Walla Ranger District, Umatilla National Forest, in May of 1974. This is a new record and a significant range extension as this aphid had never been found east of the Cascade Mountains in Oregon.

Bark beetle activity increased in both Oregon and Washington in 1974. With the exception of mountain pine beetle populations in western white pine and silver fir beetle populations in Pacific silver fir, all recorded pests caused more damage this season than in the previous year. The volume of mountain pine beetle-caused mortality in lodgepole pine stands in eastern Oregon, estimated at 79.7 mm bd. ft., has more than doubled since last year. This is a result of recorded tr e killing on nearly 423,000 acres of host type which is concentrated mostly on the Umatilla and Wallowa-Whitman National Forests and adjacent State and private lands. Fir engraver damage more than doubled in Oregon and decreased slightly in Washington. Douglas-fir beetle losses were generally light and scattered over both States. However, extensive tree killing, presumably triggered by brood buildup in ice storm-damaged and drought-weakened trees, has occurred over nearly 10,000 acres in the Cascade Mountains between Packwood and Randall, Washington. Western pine beetle losses in both Oregon and Washington remained at about the same level as 1973. However, increased activity was observed on the Fremont, Malheur, Ochoco, and Winema National Forests in Oregon. A somewhat unusual outbreak of the flatheaded fir borer, developing in drought-weakened Douglas-fir, has caused tree killing on approximately 5, 00 acres in southern Oregon between Roseburg and Medford.

DISEASE CONDITIONS IN BRIEF

The incidence of foliage diseases and weather injuries increased considerably in 1974. Both forest nurseries and forest stands were affected. Damage by gray mold blight and Fusarium top blight was common in many western Oregon and Washington nurseries. Several Christmas tree plantings suffered serious losses from foliage rusts and weather injuries. Weather damage is suspected as a primary contributing factor in the extensive mortality in Douglas-fir and ponderosa pine stands in southern Oregon.

Root rots, heart rots, and dwarf mistletoes continue to be the most important forest diseases in the Pacific Northwest.

STATUS OF INSECTS

Western spruce budworm, *Choristoneura occidentalis* Free. Infestations of the western spruce budworm have more than doubled in area since last year. Slightly more than one-half million acres of Douglas-fir and true fir have been defoliated to some extent this year. The majority of the damage has occurred on the Okanogan and Wenatchee National Forests and

the North Cascades National Park in north central Washington. Scattered feeding, totaling less than 2,000 acres, has occurred on the Wallowa-Whitman National Forest in Oregon and a new center, totaling 7,200 acres and consisting primarily of light defoliation, was recorded on the Warm Springs Indian Reservation.

Some apparent top killing has occurred as a result of continuous defoliation over the past 4 years. However, no mortality has been observed. It is generally believed that most of the affected stands can sustain 2 or possibly even 3 more years of feeding before significant top killing will occur because the majority of the outbreaks are only 1 or 2 years old. These outbreaks are expected to continue in 1975. However, the trends will not be definitely known until data collected this fall during an egg mass survey and stand hazard appraisal have been analyzed (see attached map

Modoc budworm, *Choristoneura viridis* Free. Populations of this insect, more than doubling in area, caused primarily light defoliation over approximately 90,000 acres of white fir type on the Fremont National Forest. New defoliation occurred this year over most of the North Warner Mountains and the Gearhart Wilderness area. The current level of defoliation has not resulted in serious tree damage. Cone production has been apparently affected and some scattered top killing has been observed in isolated locations that have suffered 3 years of continuous defoliation. However, no mortality has been observed in any of the outbreak. These outbreaks are expected to continue next year. However, the actual trends will not be known until data collected this fall during an egg mass survey and stand hazard appraisal have been analyzed (see attached map for outbreak locations).

Sugar pine tortrix, *Choristoneura lambertianae* (Busck). A new center, totaling 720 acres and consisting primarily of light defoliation, was observed in the vicinity of Drake Mountain (North Warner Mountains) on the Lakeview Ranger District, Fremont National Forest. The trend of this infestation is not known. However, it is not expected to cause any serious problems next year.

Larch casebearer, *Coleophora laricella* Hbn., continued to spread in western larch stands throughout eastern Washington and northeast Oregon. The insect has not yet been observed in the Cascade Mountains of Oregon or Washington or in the Ochoco Mountains of central Oregon. No formal detection surveys were conducted this year. However, field observers indicated that defoliation was generally less than that of last year. This may, in part, have been a result of the cool and damp weather which existed throughout much of the Pacific Northwest this last spring.

Douglas-Fir tussock moth, *Orgyia pseudotsugata*, McD. Populations of this pest were reduced to nearly non-detectable levels following the application of DDT on 356,505 acres of infested forest lands in Oregon and Washington this past summer. No significant defoliation was observed in any treated areas and only one new center, totaling less than 10 acres in Stevens County, Washington, was found. During the summer following completion of the suppression project approximately 2,200 miles of timber land road system in Oregon and Washington were surveyed in an attempt to find tussock moth larvae. No active populations were detected.

356,505

The results of a recently completed egg mass survey indicate that the control effort was quite successful. No egg masses were found in any of the treatment areas except on the Pomeroy Unit in the vicinity of Anatone Butte. (see attached map for location of treatment areas)

Balsam woolly aphid, *Adelges piceae* (Ratz.), infestations continued to cause damage in the true fir stands of western Oregon and Washington. However, the amount of visible damage detected during the annual aerial survey in Oregon was approximately 100,000 acres less than the amount observed in 1973. Most of the observable damage occurs on the Willamette, Mt. Hood and Deschutes National Forests in Oregon and the Gifford Pinchot and Snoqualmie National Forests in Washington. However, a light infestation, not detectable from the air, was found in a small grove of subalpine fir near the headwaters of Tiger Creek on the Walla Walla Ranger District, Umatilla National Forest, in May of 1974. The results of a recent ground survey indicate that the insect is established in the subalpine type within a 3-mile radius of the initial find. Bole dissections indicate that host trees have been infested for at least 7 years. No top-killing or tree mortality has been observed and no damage has been observed on any grand fir (see attached map for location of infestations).

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., continued to cause serious losses in lodgepole pine stands in Oregon. Approximately 80 million board feet of timber has been killed this past year. Nearly three-quarters of this loss has occurred on the Umatilla and Wallowa-Whitman National Forests. In Washington, losses in lodgepole pine continued to be light. Losses of western white pine declined throughout the mountainous regions of both States. In Oregon, the heaviest tree killing occurred on the Willamette National Forest while those in Washington occurred on the Snoqualmie and Wenatchee National Forests. Mountain pine beetle attacks in pole-size ponderosa pine increased slightly in both States with significant increases occurring on the Colville Indian Reservation in Washington and on State and private lands in the vicinity of Dooley Mt. in northeastern Oregon (see attached map for mountain pine beetle activity).

Fir engraver, *Scolytus ventralis* Lec., populations have generally increased over the Pacific Northwest. Losses in true firs were generally light over much of eastern Oregon and Washington. Significant damage in Oregon occurred on the Malheur, Umatilla, and Wallowa-Whitman National Forests. In Washington, the Mt. Baker, Okanogan, and Wenatchee National Forests received the most damage. The trend of these infestations is unknown.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk., killed approximately 16.8 mm bd. ft. of Douglas-fir in Oregon and Washington in 1974. Losses this past year were slightly more than twice those of last year. The longest outbreaks have been observed on the Mt. Hood, Umpqua, Willamette and Gifford Pinchot National Forests. The most severe infestation is located on the Packwood Ranger District on the Gifford Pinchot National Forest within and adjacent to the Davis Mountain roadless area. An estimated 75 million bd. ft. of dead, green-infested and ice storm-damaged timber is being prepared for sale this fall.

The District is hopeful that the infested material will be logged by May 1, 1975, before the beetles emerge to infest other trees (see attached map for Douglas-fir beetle activity).

Spruce beetle, *Dendroctonus rufipennis* (Kby.). Tree killing continued in Engelmann spruce stands on the Okanogan National Forest in Washington. Elsewhere in Oregon and Washington, spruce beetle populations are generally increasing. Aerial detection surveys reported numerous widely scattered new patches of mortality. The trend of these outbreaks is unknown.

Western pine beetle, *Dendroctonus brevicomis* LeC., infestations continued in several mature and overmature ponderosa pine stands in Central Oregon where nearly 7 million bd. ft. of timber has been killed on the Fremont, Malheur, Ochoco and Winema National Forests. In Washington, losses were light with widely scattered tree killing occurring on most east side forests.

Flatheaded fir borer, *Melanophila drummondi* (Kirby). An outbreak of flatheaded borers developed on approximately 5,800 acres of low site forest lands in southwestern Oregon between Roseburg and the Oregon-California State line. Most of the tree killing occurs on dry rocky sites located along the foothills of the Rogue and Umpqua River drainages in the vicinity of Riddle, Grants Pass, Medford and Ashland. The probable cause of this outbreak is attributed, in large part, to the effect of adverse weather conditions on host tree; namely, unusually low temperatures in December 1972, followed by a long and severe drought in 1973.

The trend of this outbreak is not known. However, tree killing is expected to subside with the occurrence of normal precipitation.

Other insects: Gypsy moth, *Porthetria dispar* (L.). An adult male was captured this past summer in a pheromone trap placed in a residential area in Seattle, Washington. No additional adults were captured during a more comprehensive trapping program.

According to Dick Jackson, USDA, Plant Protection Officer and coordinator of the trapping program, additional evidence of gypsy moth has been found on mobile homes in Coeur d'Alene, Idaho and in Bend and Pendleton, Oregon. The find at Bend included dead larvae and an old egg mass. Followup surveys are planned for 1975.

European pine shoot moth, *Rhyacionia buoliana* (Schiff.). The European pine shoot moth pheromone was used operationally for the first time as a survey tool. Baited sticky traps were placed in the field from May through July in Jackson, Josephine, Clackamas, Washington, Multnomah and Umatilla Counties, Oregon, to attract and detect the presence of shoot moth.

Adult insects were found at Hermiston, Umatilla, Hat Rock Park, McNary Dam, McNary Golf Course and in a residential area of Pendleton, all within Umatilla County.

No shoot moths were detected in the other five counties.

STATUS OF FOREST TREE DISEASES IN OREGON AND WASHINGTON IN 1974

Gray mold blight caused by *Botrytis cinerea*, Pers. damaged seedlings in many of the forest nurseries in western Oregon and Washington. The increase in damage is directly attributable to the prolonged moist period which extended into late June. The disease is most damaging in dense beds where the foliage remains damp for several days. It can be prevented by thinning beds to promote foliage drying. Several fungicides including Bordeaux, maneb, zineb, ferbam, captan and thiram are effective in preventing gray mold blight.

Fusarium top blight, caused by species of *Fusarium* also was common in many forest nurseries this year. It can be prevented by avoiding excess moisture on foliage for long periods. Benlate has been found to be effective in preventing the disease in studies conducted by the Washington Department of Natural Resources.

Douglas-fir needle rust, caused by *Melampsora occidentalis*, damaged several Christmas tree plantings in Oregon and Washington in 1974. In some cases trees were so severely infected that they were rendered worthless for Christmas trees. The rust has an alternate host of black cottonwood. Damage can be reduced by removing cottonwood trees from the immediate vicinity of Douglas-fir Christmas tree plantings.

Other foliage diseases observed this year include *Melampsora - abieti - capraearum* on approximately 200 acres of grand fir on the Yakima Indian Reservation, a *Dothistroma - lophodermium* complex on lodgepole pine along the Oregon coast, *Rhabdocline pseudotsugae* on Douglas-firs in many areas of Oregon and Washington, and larch needle cast caused by *Hypodermella laricis* in several larch stands in eastern Washington and northeastern Oregon.

Weather injuries to several tree species were very noticeable in 1974.

Extensive drought injury or scorch occurred over much of western Washington. Apparently a single week of extremely hot weather early in June when foliage was succulent caused the injury. Nearly all the grand fir in Washington Christmas tree plantations have had some degree of damage. Noble fir and Douglas-firs were affected to a lesser degree.

Freeze damage to the tops of conifers was common in the vicinity of Olympia, Washington. The top 5-20 feet of trees were killed by low temperatures.

Weather injury is strongly suspected as a contributing factor of extensive mortality of Douglas-firs and ponderosa pine in southern Oregon between Roseburg and Medford. An area around Canyonville and Riddle was highly visible from I-5 and generated considerable news coverage. Very cold weather experienced during December 1972 is suspected as the initial cause of the injury. Secondary damage by bark beetles was evident in dead and stressed trees. The Oregon State Department of Forestry is planning additional evaluations in the damaged areas.

Root rots, heart rots, and dwarf mistletoes continue to be the most important disease problem in the Pacific Northwest. There is very little if any change in the yearly incidence of these types of diseases.

A roadside survey for Port-Orford-cedar root rot caused by *Phytophthora lateralis* was conducted on 3 Districts of the Siskiyou National Forest in 1974. Approximately 55 percent of the 450-plus miles of roads examined were infected. This represents a very discouraging dramatic increase from a similar survey conducted in 1964 when the root rot was found to be just beginning to encroach on the Forest. A plant pathologist has been hired by Oregon State University with funds made available by Coos, Curry and Douglas Counties. This pathologist will devote all of his time to Port Orford-cedar root rot for a minimum of 1 year.

Several additional infection centers of the black stain root disease were found in Douglas-fir stands in the vicinity of the Umpqua National Forest. Many infection centers which appear to be caused by *Poria weirii* are really caused by the black stain root disease, *Verticicladiella wagenerii*. Usually only a relatively small number of trees are killed in any one infection center.

A survey of 361 plantations ranging in age from 1 to 30 years revealed that Armillaria root rot is the most common disease found in plantations. Weather injury, white pine blister rust and *Phellinus weirii* were also frequently observed diseases.

The generic name of *Poria weirii* has been changed to *Phellinus weirii*.

The first large scale use of borax treatments to prevent infection of stumps by the root rot fungus *Fomes annosus* was made on the Fremont National Forest in September. Ponderosa pine stumps on approximately 150 acres adjacent to an infected plantation were treated. The cost averaged about $4.50 per acre for materials and application. A very productive mycorrhizal conference was held in Corvallis in August. Mycorrhizal workers from all over the world attended.

Seed production by Douglas-fir dwarf mistletoe, *Arceuthobium douglasii*, and larch dwarf mistletoe, *A. laricis*, was very poor in 1974. In contrast, ponderosa pine dwarf mistletoe unfortunately produced a bumper crop.

A slide-tape program titled "Defect estimation in white fir on the Rogue River National Forest--a guide for cruisers," was prepared by the U.S. Forest Service this year. Copies will soon be available for purchase.

A survey of 30 lodgepole pine stands was conducted by the U.S. Forest Service in 1974 to measure the incidence of diseases. The following data were recorded:

Western gall rust was present in 23 stands and more than 28 percent of trees were infected
Dwarf mistletoe was present in 20 stands
Stalactiforme rust was present in 8 stands
Atropellis canker was found in 9 stands

The survey indicated diseases cause large losses in lodgepole pine stands.

A study was made by the U.S. Forest Service of the extent of defect associated with top-kill caused by the Douglas-fir tussock moth outbreak in 1964 near Burns. During the study, 9 grand firs and 7 Douglas-firs with dead tops were dissected to measure how far down the trees stain and decay had progressed. The extent of defect was very limited in Douglas-firs but wetwood, stain, and decay were common in grand fir and were found several feet down from the interface of the dead and live tops. Work is still underway on identification of the organisms involved. A report will be issued next spring.

Table 1.--Summary of 1974 budworm epidemic infestations in Oregon and Washington

STATE / FOREST	Defoliation			
	Light (Acres)	Moderate (Acres)	Heavy (Acres)	Total (Acres
WESTERN SPRUCE BUDWORM *Choristoneura occidentalis* Free				
Oregon				
Wallowa-Whitman N.F.	1,980	--	--	1,980
Warm Springs I.R.	6,920	--	280	7,200
Sub-total (Oregon	8,900	--	280	9,180
Washington				
Okanogan N.F.	156,340	17,200	2,600	176,140
Wenatchee N.F.	302,270	35,130	3,040	340,440
North Cascades N.F.	18,220	5,200	480	23,900
Sub-total (Washington)	476,830	57,530	6,120	540,480
Sub-total (*C. occidentolis*)	485,730	57,530	6,400	549,660
MODOC BUDWORM *C. viridis* Free				
Oregon				
Fremont N.F.	72,040	12,370	5,160	89,570
Sub-total (*C. viridis*)	72,040	12,370	5,160	89,570
Total (*C. occidentolis* and *C. viridis*)	557,770	69,900	11,560	639,230

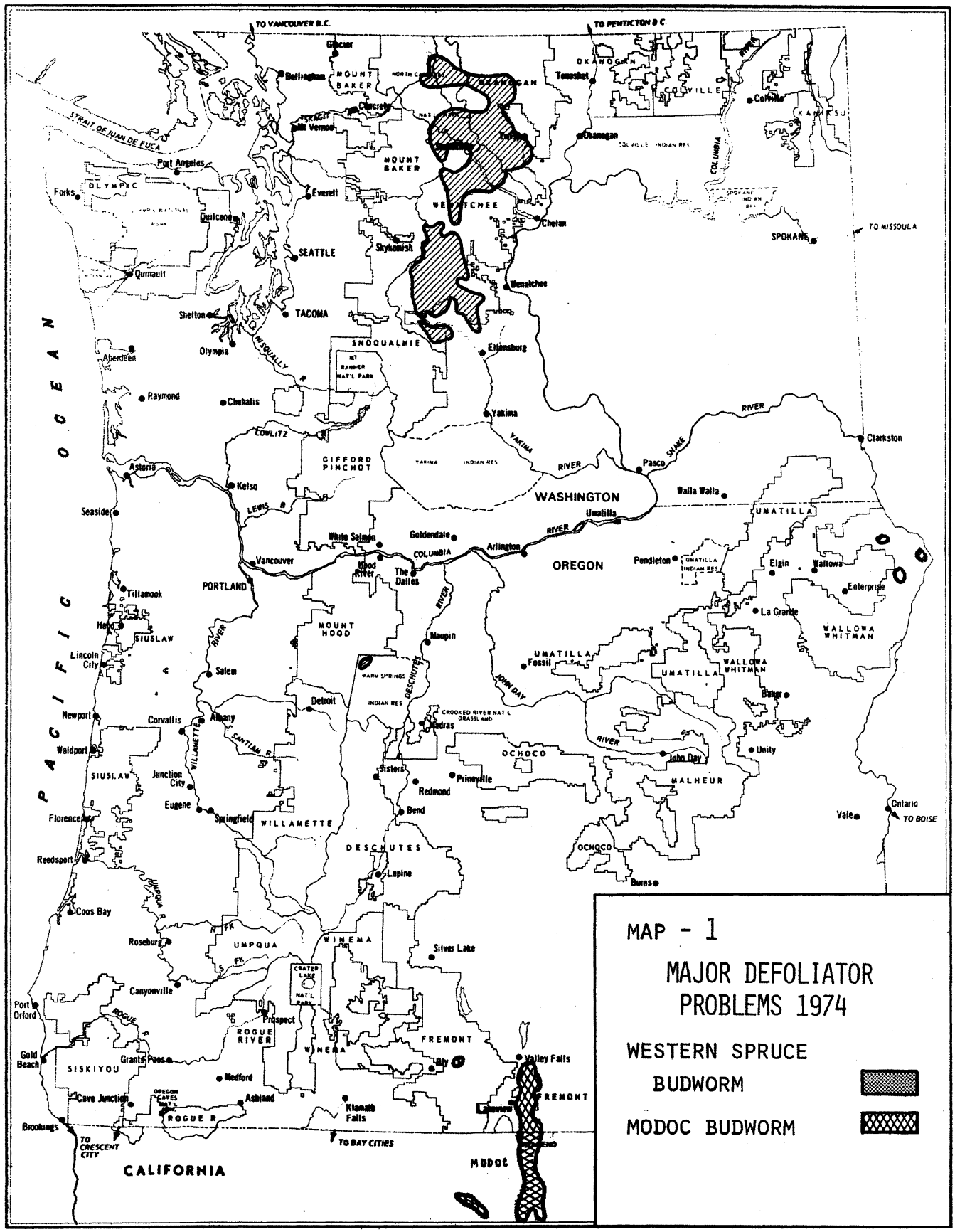
Table 2.--Summary of 1974 forest insect epidemic infestations in Oregon and Washington

Insects	Oregon		Washington		Regional total	
	Infestation centers	Area	Infestation centers	Area	Infestation centers	Area
	Number	Acres	Number	Acres	Number	Acres
Defoliators:						
Sawflies on larch	2	560	0	0	2	560
Sawflies on knobcone pine	13	1,080	0	0	13	1,080
Spruce budworm	41	98,750	168	540,484	209	639,234
Douglas-fir tussock moth	31	30,930	1	40	32	30,970
Sugar pine tortrix	1	760	0	0	1	760
All defoliators	88	132,080	169	540,524	257	672,604
Sucking insects:						
Balsam woolly aphid	171	11,500	56	11,320	227	22,820
All sucking insects	171	11,500	56	11,320	227	22,820
Other:						
Oregon pine ips	311	15,760	15	1,250	326	17,010
All other	311	15,760	15	1,250	326	17,010
Not an insect:						
Bear damage	2	120	43	4,890	45	5,010
All not an insect	2	120	43	4,890	45	5,010
All damage	572	159,460	283	557,984	855	717,444

Table 3.--Summary of 1974 forest epidemic infestations in Oregon and Washington for all bark beetle damage excluding Oregon pine ips

Insects[1/]	Infestation centers	Area	Number of trees	Volume
	Number	Acres	Number	Board feet
Oregon:				
Douglas-fir beetle (east side)	134	6,870	2,572	2,174,280
Douglas-fir beetle (west side)	190	2,850	4,540	7,663,200
Douglas-fir engraver	3	170	40	52,100
Engelmann spruce beetle	15	850	285	71,250
Fir engraver	332	31,620	13,633	3,583,770
Flatheaded borer	222	5,750	6,152	11,135,120
Mountain pine beetle (L)	1,167	422,610	1,139,714	79,710,680
Mountain pine beetle (S)	12	2,020	510	287,800
Mountain pine beetle (W)	140	3,750	5,845	2,734,400
Mountain pine beetle (P)	638	55,380	58,916	3,522,370
Western pine beetle	577	106,110	8,928	6,873,350
Oregon total	3,430	637,980	1,241,135	117,808,320
Washington:				
Douglas-fir beetle (east side)	56	6,890	3,565	1,960,750
Douglas-fir beetle (west side)	102	11,130	5,799	5,021,160
Engelmann spruce beetle	24	3,250	3,890	972,500
Fir engraver	99	9,630	6,805	1,754,000
Mountain pine beetle (L)	52	4,950	3,580	250,600
Mountain pine beetle (W)	278	26,980	19,170	8,659,200
Mountain pine beetle (P)	265	12,320	10,651	537,160
Western pine beetle	33	4,540	452	267,780
Silver fir beetles	4	680	55	71,250
Washington total	913	80,370	53,967	19,494,400
Regional total	4,343	718,350	1,295,102	137,302,720

1/ Mountain pine beetle infestations are separated by tree species: L, lodgepole pine; S, sugar pine; W, western white pine; P, ponderosa pine.


TO VANCOUVER B.C.
TO PENTICTON B.C.
PACIFIC OCEAN
STRAIT OF JUAN DE FUCA
WASHINGTON
OREGON
CALIFORNIA
SEATTLE
TACOMA
PORTLAND
SPOKANE
TO MISSOULA
TO BOISE
TO CRESCENT CITY
TO BAY CITIES
Bellingham
Port Angeles
Forks
Everett
Quilcene
Quinault
Shelton
Olympia
Aberdeen
Raymond
Chehalis
Astoria
Seaside
Tillamook
Kelso
Vancouver
White Salmon
Goldendale
Arlington
Umatilla
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Yakima
Ellensburg
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Chelan
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Lincoln City
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Salem
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Prospect
Klamath Falls
Lakeview
Valley Falls
Fremont
Silver Lake
Lapine
Burns
Unity
John Day
Baker
Pendleton
Elgin
Wallowa
Enterprise
La Grande
Fossil
Ontario
Vale
Hood River
The Dalles
Pendleton
Mount Baker
Glacier
Skagit
Snoqualmie
Wenatchee
Okanogan
Gifford Pinchot
Yakima Indian Res
Colville Indian Res
Spokane Indian Res
Umatilla Indian Res
Warm Springs Indian Res
Crooked River Nat'l Grassland
Crater Lake Nat'l Park
Oregon Caves Nat'l Mon.
Mt Rainier Nat'l Park
Columbia River
Yakima River
Snake River
Lewis R.
Cowlitz
Willamette
Santiam R.
Deschutes River
John Day River
Umpqua
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Rogue River
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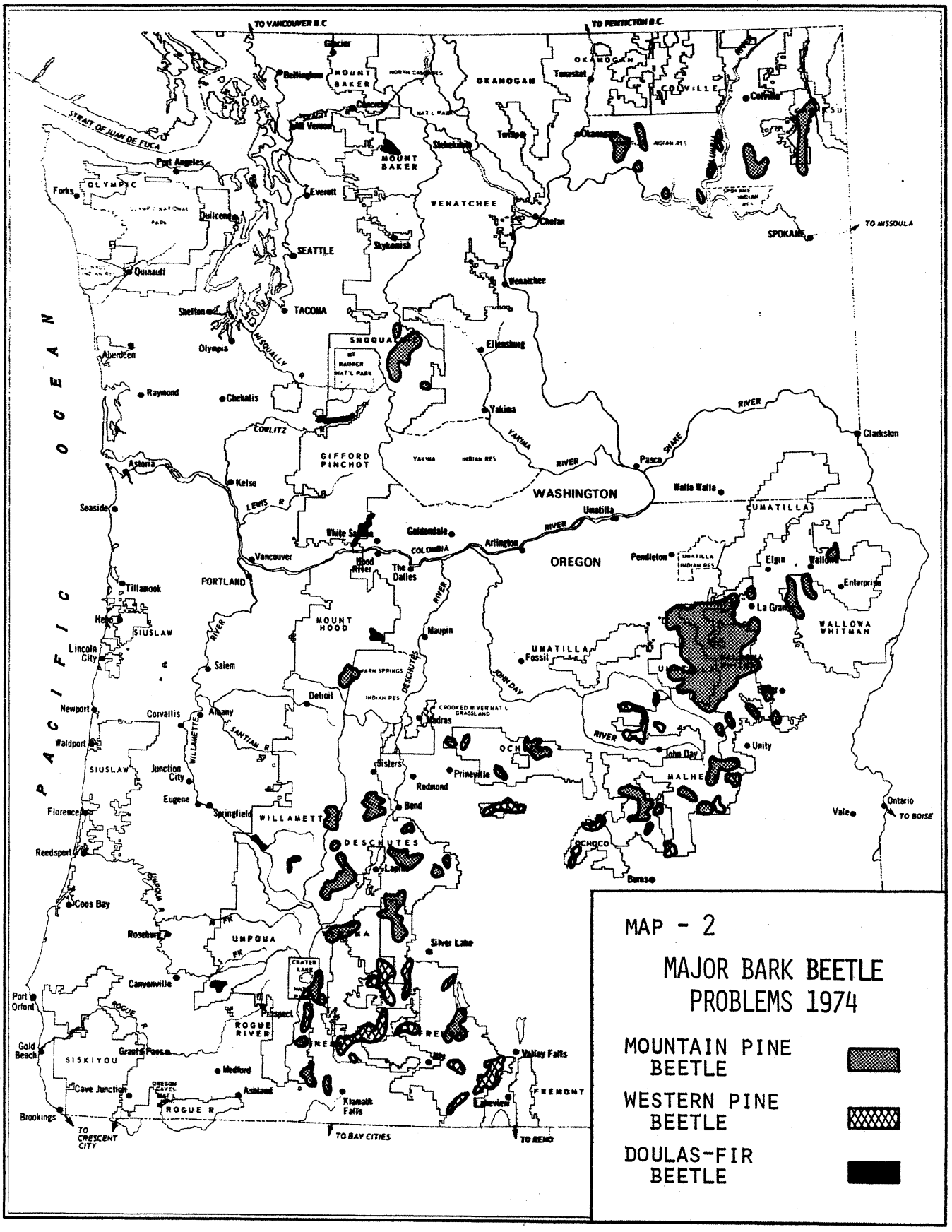
Umpqua
Willamette
Deschutes
Ochoco
Malheur
Wallowa Whitman
Umatilla
Winema
Fremont
Modoc
MAP - 1
MAJOR DEFOLIATOR PROBLEMS 1974
WESTERN SPRUCE BUDWORM
MODOC BUDWORM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WENATCHEE
SEATTLE
TACOMA
SNOQUALMIE
GIFFORD PINCHOT
YAKIMA INDIAN RES
WASHINGTON
OREGON
PORTLAND
MOUNT HOOD
DESCHUTES
WILLAMETTE
UMPQUA
ROGUE RIVER
SISKIYOU
FREMONT
UMATILLA
WALLOWA WHITMAN
MALHEUR
OCHOCO
TO MISSOULA
TO BOISE
TO RENO
TO BAY CITIES
TO CRESCENT CITY
Port Angeles
Forks
Everett
Bellingham
Mt. Vernon
Wenatchee
Chelan
Spokane
Yakima
Ellensburg
Olympia
Aberdeen
Raymond
Chehalis
Kelso
Longview
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Vancouver
Goldendale
Arlington
Pasco
Walla Walla
Clarkston
Pendleton
Elgin
Enterprise
La Grande
Baker
Ontario
Vale
Burns
Unity
John Day
Prineville
Redmond
Bend
Sisters
Madras
Maupin
The Dalles
Hood River
Detroit
Salem
Albany
Corvallis
Newport
Waldport
Florence
Reedsport
Coos Bay
Roseburg
Canyonville
Port Orford
Gold Beach
Grants Pass
Medford
Ashland
Cave Junction
Brookings
Klamath Falls
Lakeview
Silver Lake
Valley Falls
Prospect
Crater Lake
Lincoln City
Junction City
Eugene
Springfield
Lebanon
Maupin
Fossil
Condon
Mitchell
Dayville
Monument
Canyon City
Long Creek
Ukiah
Heppner
Hermiston
Umatilla
Boardman
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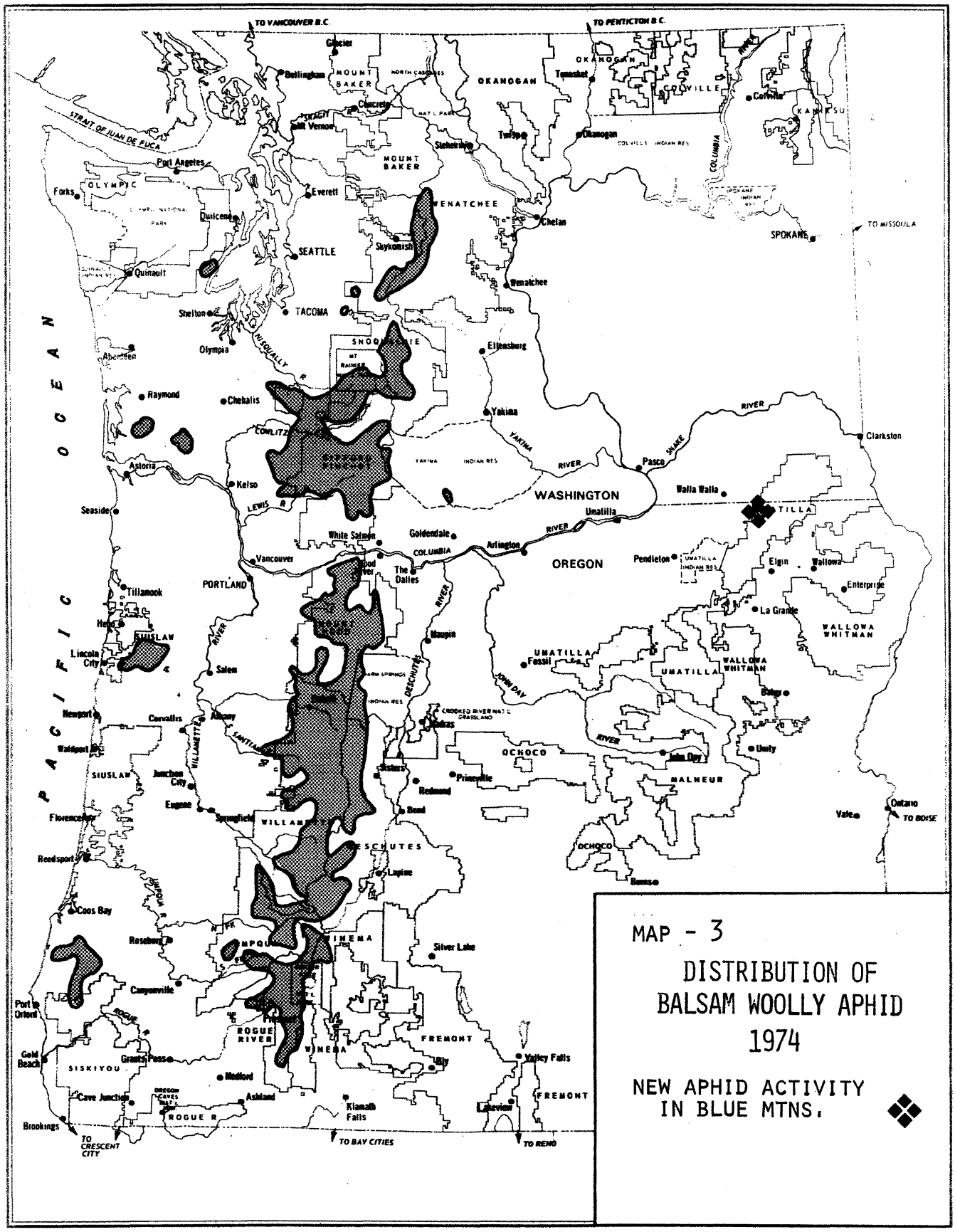
MAP - 2
MAJOR BARK BEETLE PROBLEMS 1974
MOUNTAIN PINE BEETLE
WESTERN PINE BEETLE
DOULAS-FIR BEETLE


TO VANCOUVER B.C.
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WASHINGTON
OREGON
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OKANOGAN
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COLVILLE
Colville
KANIKSU
Concrete
Sedro Woolley
Twisp
Okanogan
COLVILLE INDIAN RES
COLUMBIA
Port Angeles
Forks
OLYMPIC
Everett
WENATCHEE
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SPOKANE
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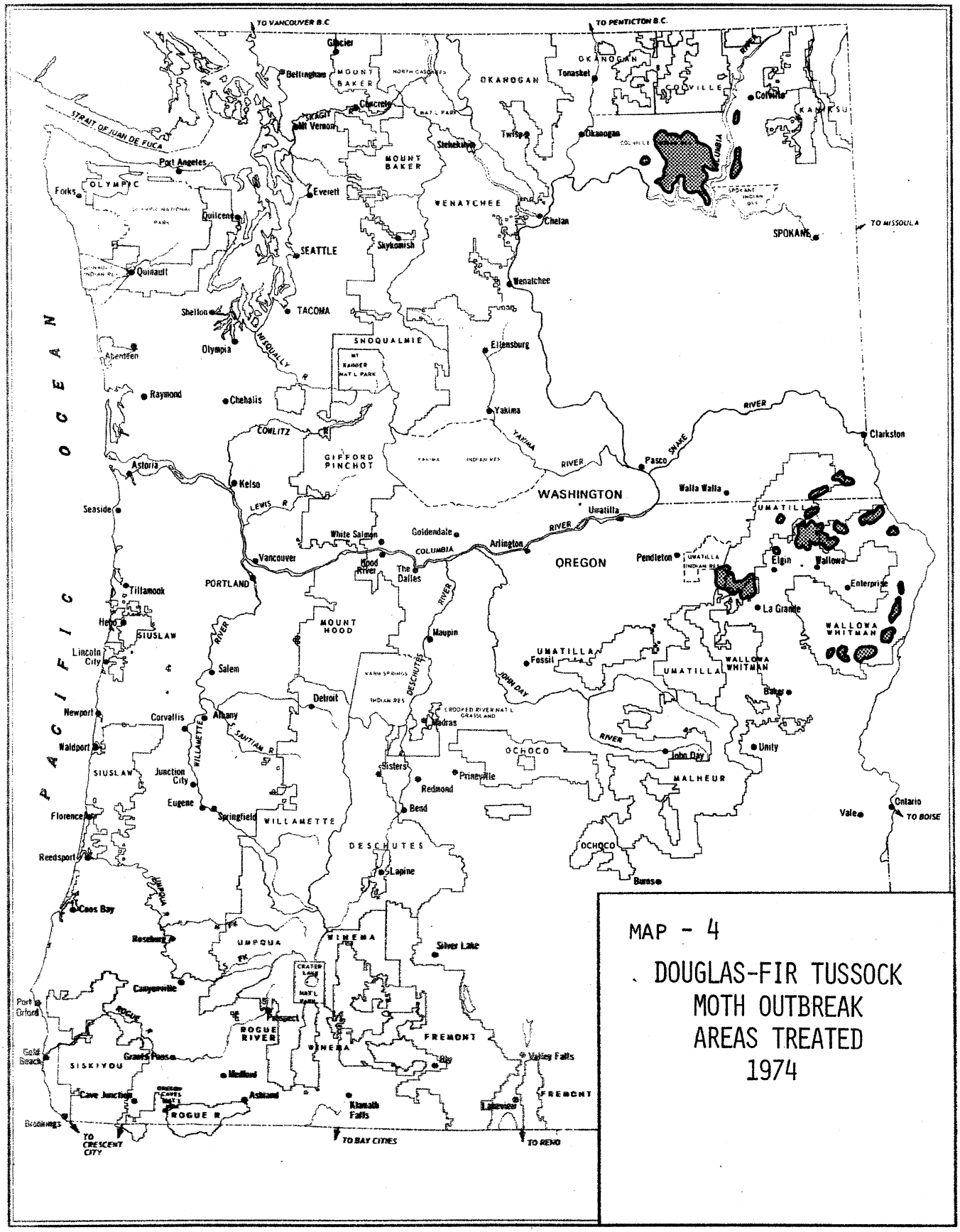
Olympia
Aberdeen
Ellensburg
Raymond
Chehalis
Yakima
YAKIMA INDIAN RES
Clarkston
Astoria
Kelso
Pasco
Walla Walla
Seaside
Umatilla
TILLA
White Salmon
Goldendale
Arlington
Vancouver
Pendleton
UMATILLA INDIAN RES
Elgin
Wallowa
Enterprise
PORTLAND
The Dalles
Tillamook
La Grande
WALLOWA WHITMAN
Maupin
Lincoln City
Salem
UMATILLA
Fossil
Newport
Corvallis
Albany
Madras
Burns
Waldport
Junction City
Eugene
Springfield
Prineville
Redmond
Bend
Vale
Ontario
TO BOISE
Florence
Reedsport
Lapine
Coos Bay
Roseburg
Silver Lake
Canyonville
Port Orford
Gold Beach
Grants Pass
Medford
Ashland
Cave Junction
Klamath Falls
Lakeview
Valley Falls
Brookings
TO CRESCENT CITY
TO BAY CITIES
TO RENO
MAP - 3
DISTRIBUTION OF
BALSAM WOOLLY APHID
1974
NEW APHID ACTIVITY
IN BLUE MTNS.


TO VANCOUVER B.C.
TO PENTICTON B.C.
TO MISSOULA
TO BOISE
TO BAY CITIES
TO RENO
TO CRESCENT CITY
PACIFIC OCEAN
STRAIT OF JUAN DE FUCA
WASHINGTON
OREGON
Glacier
Bellingham
Tonasket
Colville
Okanogan
Twisp
Chelan
Wenatchee
Ellensburg
Yakima
Clarkston
Pasco
Walla Walla
Umatilla
Pendleton
Elgin
Wallowa
Enterprise
La Grande
Baker
Unity
John Day
Ontario
Vale
Burns
Port Angeles
Forks
Everett
Quilcene
SEATTLE
Skykomish
Quinault
Shelton
TACOMA
Olympia
Aberdeen
Raymond
Chehalis
Astoria
Kelso
Seaside
Tillamook
Lincoln City
Newport
Waldport
Florence
Reedsport
Coos Bay
Roseburg
Canyonville
Port Orford
Gold Beach
Grants Pass
Cave Junction
Brookings
Medford
Ashland
Klamath Falls
Lakeview
Valley Falls
Prospect
Crater Lake
White Salmon
Goldendale
Arlington
Vancouver
Hood River
The Dalles
PORTLAND
Salem
Albany
Corvallis
Eugene
Springfield
Junction City
Detroit
Maupin
Madras
Sisters
Redmond
Prineville
Bend
Lapine
Silver Lake
Fossil
MOUNT BAKER
OKANOGAN
WENATCHEE
SNOQUALMIE
GIFFORD PINCHOT
MOUNT HOOD
DESCHUTES
OCHOCO
MALHEUR
UMATILLA
WALLOWA WHITMAN
WILLAMETTE
SIUSLAW
UMPQUA
ROGUE RIVER
SISKIYOU
FREMONT
COLUMBIA
SNAKE RIVER
YAKIMA RIVER
JOHN DAY RIVER
DESCHUTES RIVER
MCKENZIE
SANTIAM R.
UMPQUA
ROGUE R.
MAP - 4
DOUGLAS-FIR TUSSOCK MOTH OUTBREAK AREAS TREATED 1974